NEUTRA

White Paper
Building the infrastructure for high-integrity, tokenised carbon credits

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Glossary of Terms

Accreditation: Formal recognition that a carbon project or credit meets the standards set by certification bodies such as Gold Standard or Verra.

Additionality / Additional (Carbon Reductions): Emissions reductions that occur only because of the project and would not have happened under a "business as usual" scenario.

Air-Source Heat Pump (ASHP): An energy-efficient heating system that transfers heat from outdoor air into a building, replacing fossil fuel heating.

Auditability: The ability for external parties to independently verify the data and claims behind credits or sustainability reports.

Cap-and-Trade: A regulated emissions reduction system that sets a cap on total emissions and enables trading of allowances.

Carbon Credit: A tradable certificate representing one metric tonne of carbon dioxide equivalent (tCO_2e) avoided, reduced, or removed.

Carbon Dioxide Equivalent (tCO_2e): A standard unit measuring the global warming impact of different greenhouse gases as CO_2 equivalents.

Carbon Offset: The action of compensating for emissions by purchasing credits representing reductions elsewhere.

Compliance Carbon Market: A regulated market where companies are legally required to hold emissions allowances and trade them.

Decarbonisation: The process of reducing or eliminating carbon dioxide emissions from activities such as heating or electricity use.

ESG (Environmental, Social, and Governance): A framework to evaluate a company's sustainability, ethics, and governance performance.

Forward Credit: A credit sold in advance based on forecasted future emissions reductions.

Gold Standard: A certification body providing frameworks to verify high-quality carbon credits.

Greenwashing: Overstated or misleading claims about environmental impact.

High-Integrity Credit: A credit meeting rigorous standards for being real, additional, permanent, and verifiable.

Lifecycle Emissions: Total emissions from a product or installation over its entire lifespan.

Lifetime Issuance Model: Crediting approach where all projected emissions reductions are issued upfront.

Net Zero: A balance between emissions produced and emissions removed from the atmosphere.

Real-World Asset (RWA): A tangible asset, such as verified emissions reductions, used to create carbon credits.

Retirement (of Credits): The permanent removal of a credit from circulation so it cannot be reused.

Social Co-Benefits: Positive social outcomes created by a project (e.g., improved air quality, local jobs).

Sustainable Development Goals (SDGs): Seventeen UN goals targeting environmental protection, health, and economic opportunity.

Traceability: The ability to track the origin and lifecycle of a carbon credit to confirm authenticity.

Transparency: Open disclosure of project data and verification processes to build trust.

Verification-as-a-Service (VaaS): A service providing independent validation of emissions reductions and credit issuance.

Verified Carbon Standard (Verra): A widely used certification program ensuring credits meet high integrity standards.

Voluntary Carbon Market (VCM): Markets where organisations buy credits to meet self-imposed climate commitments.

Voluntary Carbon Markets Integrity Initiative (VCMI): An initiative providing guidance and claims codes for credible use of voluntary credits.

1. Executive Summary

Carbon markets are expanding rapidly despite continuing to suffer from a lack of high-quality, verifiable, and local carbon credits. Most offset solutions focus on distant, large-scale projects with no transparency and limited relevance to corporate Environmental, Social, and Governance (ESG) mandates or domestic energy transitions[1].

Neutra bridges this gap by tokenising the carbon savings generated when homeowners install air-source heat pumps (ASHPs). By verifying and bundling these emissions reductions annually and minting them as on-chain carbon credits, Neutra creates a new class of real-world assets (RWAs) that are tied directly to traceable and transparent decarbonisation. These credits are sold to ESG-focused corporate buyers, and the proceeds are distributed as recurring annual cashback payments to homeowners, creating benefits at every level of the value chain.

Each installation can save between 1.5 to 4 tonnes of CO_2 annually[2], and the addressable market spans millions of homes across the UK and Europe. A portfolio of 100,000 homes will generate approximately 200,000 tonnes of tokenised CO_2 savings every year, creating sustained revenue to incentivise long-term adoption.

Neutra's long-term vision is to become the standard infrastructure for carbon credit markets by connecting policy-driven climate initiatives with real-time, verifiable market incentives. The first stage of this project is focusing on household-scale emissions reductions, with a target to scale across sectors, enabling the tokenisation of distributed, measurable climate actions at a national and eventually global level.

2. Market Context and Strategic Fit

2.1 Carbon Credits and Carbon Markets

Carbon credits are tradable permits that represent one metric tonne of carbon dioxide equivalent (tCO_2e) either avoided, reduced, or removed from the atmosphere. They are a foundational mechanism for financing climate action and incentivising emissions reductions across sectors when a company emits more carbon than its internal reduction measures can account for. By purchasing and retiring these credits, companies can meet voluntary climate commitments, enhance their ESG profiles and comply with emissions reduction targets.

There are two primary markets for carbon credits:

- **Compliance Markets** are government-regulated systems where companies are legally required to hold emissions allowances, often under a cap-and-trade regime. Participants trade credits to meet regulatory obligations under schemes like the EU Emissions Trading System (EU ETS)[3] or California's Cap-and-Trade Program[4].
- **Voluntary Carbon Markets (VCM)** operate outside of regulation, where organisations and individuals purchase credits to offset their carbon footprints or meet ESG targets. These markets are growing rapidly, driven by net-zero commitments and increasing stakeholder pressure for climate accountability.

Carbon credits originate from verified projects that deliver measurable environmental benefits, including renewable energy, reforestation, industrial efficiency and household-level decarbonisation. As per the Verified Carbon Standard (VCS) quality assurance principles, each credit must meet strict criteria: the reduction must be real, measurable, additional, permanent, and independently verified, conservatively estimated, uniquely numbered and transparently listed[5].

2.2 Carbon Market Challenges

Over the past two years, VCMs have experienced a period of adjustment. Overall transaction volumes declined by around 25 % in 2024 as buyers reassessed credit quality and verification standards[6]. However, most of this decline was concentrated in low-integrity credits with weak additionality or poor transparency. In contrast, demand for high-quality, verifiable credits remained resilient, with BloombergNEF[7] projecting that the market could still grow to $1 trillion by 2050 if integrity standards are widely adopted.

Most of today's carbon credits originate from large-scale, remote projects, (such as reforestation or industrial efficiency), located far from the buyers who purchase them. These credits often face criticism over low verification standards and limited proof of real-world impact. Investigations revealed that up to 90% of rainforest offset credits issued by leading standards bodies may have had no measurable climate benefit, casting doubt on the environmental integrity of widely traded credits[9,10,11,12]. The market faces a lack of transparency and traceability with carbon projects often having low verification standards, allowing unethical projects to overstate their climate impact. A comprehensive analysis of the VCM found that 87% of carbon offsets issued to major corporations likely failed to deliver "real and additional" emissions reductions[13]. These discrepancies are high risk for companies under pressure to demonstrate high-integrity, auditable ESG performance. Many offset transactions occur through opaque broker networks, limiting visibility into how credits are sourced or priced. This creates a lack of transparency that inhibits third-party accountability and creates conditions for greenwashing and misrepresentation[14]. Double counting also remains a persistent threat, where the same emissions reduction is claimed by both the offset buyer and the host country or another registry.

Neutra solves these critical issues by creating a fundamentally different approach which links carbon credits to distributed policy-aligned household upgrades that are publicly registered[10], measurable, auditable, and verified at the point of installation, meeting all the requirements laid out by the VCS quality assurance principles[5]. Neutra takes transparency even further than these principles, offering a transformative solution by providing a fully transparent and immutable, publicly accessible record of carbon credits from creation to retirement, fostering trust and verifiable environmental claims[15].

2.3 Opportunity

The UK Government and European Union have set targets to decarbonise residential heating by rapidly scaling the deployment of electric ASHPs as part of their net zero strategies[16,17].

The UK Government aims to reach 600,000 heat pump installations per year by 2028 as part of its broader net-zero strategy[18]. Through newly implemented policies (such as the Clean Heat

Market Mechanism[19]) and the removal of planning barriers, significant increases in roll-out rates for ASHPs were reported in June 2025[20].

Norway is leading the way in ASHP installations in Europe, with 632 heat pumps installed for every 1,000 households, closely followed by Finland at 524[21]. The EU's upcoming pollution tax on buildings and transport[22], (and the Social Climate Fund[23] these tax revenues will be used for), combined with the Electrification Action Plan[24], Heating and Cooling Strategy[25], and the implementation of the 2030 climate and energy laws (Fit for 55 package[26]), the ASHP market is set to grow exponentially with the implementation of these new policies which are at the forefront of driving social and environmental change. Figure 1 provides a comprehensive overview created by the European Heat Pump Association[27] on how the Fit for 55 package will boost ASHP installations.

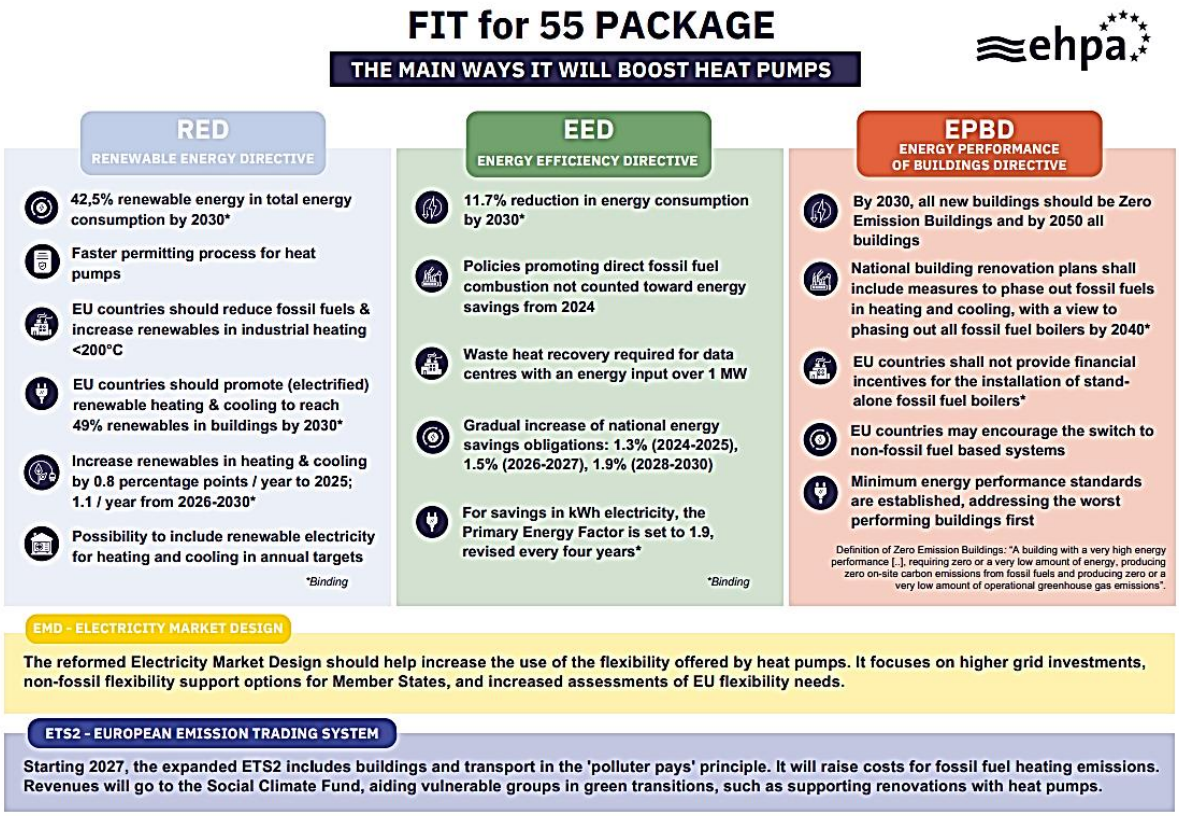

Figure 1: EHPA Fit for 55 Package: the main ways it will boost heat pumps

Aligning with UK and EU government policies not only positions Neutra to benefit from regulatory tailwinds but also increases the likelihood of long-term institutional support. This alignment positions Neutra as a first mover in connecting public mandates and private capital, accelerating climate impact while building a scalable, policy-compliant carbon asset class. Once established across Europe, Neutra's protocol will also be replicable and easily rolled out worldwide as its scalability does not rely on government grants, credits or support.

The UK government is in the process of creating a policy and governance framework[28] for helping to ensure the integrity of VCM credits and the use of credits through the six 'Voluntary Carbon and Nature Market Integrity Principles[29]. The aim of this framework is to ensure credits meet recognised high integrity criteria, ensuring claimed environmental benefits are achieved,

and boost private finance for climate action. The initiative aims to clarify what constitutes a high-quality credit, guide businesses in usage, and incentivise disclosure within sustainability reporting. By positioning itself in alignment with these government principles, Neutra stands to benefit from enhanced market credibility, potential institutional backing, and a policy-led surge in demand.

2.4 Stakeholder Value Proposition

Corporate Environmental, Social, and Governance (ESG) Buyers: Neutra enables companies to meet disclosure requirements with high-quality, verifiable credits tied to real infrastructure upgrades. Each credit is linked to a specific home installation, traceable on-chain, and exceeds current standards for transparency and prevention of misinformation. Beyond compliance, these credits offer narrative value, reflecting visible, community-level impact.

Homeowners: Access to a new financial incentive that provides recurring annual cashback payments based on verified carbon savings, reducing lifetime costs and improving the payback profile of installing an ASHP.

Regulators: Neutra tackles the rising regulatory scrutiny by embedding auditability and protection against fraud at the protocol level. Credits are minted from standardised, verifiable installation data, with issuance and retirement of carbon credits handled on-chain. This aligns with the trajectory of carbon market reform toward high-trust digital infrastructure.

Investors: For investors, Neutra unlocks a new asset class in the form of tokenised, policy-aligned real-world decarbonisation. Neutra's carbon credits are backed by physical installations and align to climate mandates, combining environmental impact with financial infrastructure. As RWA adoption accelerates, Neutra offers durable, utility-based on-chain activity with long-term growth potential.

Blockchain Ecosystem: Within the Web3 landscape, Neutra delivers a rare use case where tokenisation supports real-world environmental outcomes. By embedding on-chain trust into climate finance workflows, the protocol generates sustainable transaction volume and public benefit, positioning blockchain as a critical tool in next-generation carbon markets[31].

2.5 Voluntary Carbon Market Analysis

After reaching an all-time high of $2 billion in transaction value in 2021[32], the market then entered a critical period of recalibration, shifting away from high-volume, low-integrity offsets and toward a new baseline of quality and transparency. This transition is positioning the market for durable, institutional-grade growth[30,33]. In 2024, the voluntary market recorded $535 million in transactions across 84 million tonnes of carbon offsets[6]. Despite lower volume, pricing remained resilient, evidencing a strong and growing preference for high-integrity credits. The VCM is now entering its second growth phase, with the potential to exceed $30 billion in annual value by 2030[30,34]. This forecast is modelled on the assumption that announced corporate and governmental climate commitments are achieved.

This next phase of the market is being shaped by integrity-focused frameworks that are now setting the benchmark for credit quality. The Integrity Council for the Voluntary Carbon Market (ICVCM) Core Carbon Principles[35] and the Voluntary Carbon Markets Integrity

Initiative (VCMI) Claims Code of Practice[36] are accelerating corporate engagement with VCMs as part of net-zero pathways.

Ernst & Young[37] (EY) notes that with more than half of the world's biggest companies setting net zero targets, this is driving demand in VCMs which in turn requires better and more rigorously enforced standards. While prices will vary across market segments, the overall trend suggests that around 30%-50% of credits will likely exceed US$50 per tonne by 2035.

"Carbon credits will become increasingly valuable, driving both emissions reductions and business innovation. As the costs of credits and abatement activities rise, business leaders who engage early and thoughtfully will be best positioned to shape the future with confidence."

EY Net Zero Centre

The composition of demand is evolving. PricewaterhouseCoopers[37] (PwC) identifies household energy efficiency as one of the most scalable and underutilised levers for real-world decarbonisation. Credits linked to distributed systems (such as clean cookstoves, waste methane capture, and ASHPs), are increasingly being recognised not only as decarbonising technologies, but also as infrastructure-grade climate investments embedded within national decarbonisation pathways. These credits command price premiums due to their traceability and alignment with regulatory targets and governance.

While the average voluntary credit price in 2024 was approximately $6.30 per tonne of carbon dioxide equivalent (tCO_2e), high-quality credits rated A to AAA by MSCI averaged $14.80 per tonne[38]. Technology-based removals, such as biochar and direct air capture, regularly exceeded $80 to $400 per tonne[39]. These premiums are expected to widen. Boston Consulting Group (BCG) and McKinsey & Company project that high-integrity credits (particularly those with additional accreditation and embedded co-benefits), will reach the value of $20 to $50 per tonne by 2030, with removals surpassing $100[32,34]. Neutra's policy-aligned, verifiable, and traceable credits are strategically positioned to capture the value segment of a rapidly maturing and in demand, premium market.

3. Solution Overview: Neutra's Value Proposition

Neutra will be the leading carbon infrastructure protocol that converts the annual carbon savings of domestic ASHP installations into verifiable, tokenised carbon credits on the blockchain. Each credit represents a 12-month emissions reduction from a certified ASHP upgrade, calculated using regulator-aligned frameworks and verified through a combination of installer data and third-party validation. These credits are then aggregated and sold to ESG-driven corporate buyers, will generate recurring cashback payments to participating households, accelerating decarbonisation at the household level.

To ensure environmental integrity, Neutra will seek Gold Standard[40] and/or Verra[5] accreditation, and register with the Berkeley Carbon Trading Project Database[41], aligning with international best practices in carbon accounting. This solution creates a new category of high-integrity, policy-aligned real-world carbon assets that are fully traceable and retired on-chain, linking local climate action with global finance.

3.1 Market and Buyer Fit

Neutra will operate within the VCM, which represents the most strategically appropriate environment for this class of carbon credit. Neutra's credits are derived from individual household-level emissions reductions, placing them in the category of community-scale offsets[42]. These credits are increasingly sought after due to their measurable social co-benefits and alignment with national decarbonisation mandates.

By targeting corporate ESG buyers firstly in the UK before branching wider across Europe, where climate disclosure regulation is accelerating, Neutra offers an offset product that is not only environmentally robust but also regulator ready. The credits meet key criteria for high market value: they are additional (generated from new installations), ongoing and cumulative (issued annually for verified performance), measurable and verifiable (backed by third-party data and smart contract issuance), and socially aligned (supporting national heating and energy transition goals).

As the VCM shifts toward more localised and high-integrity supply, Neutra's credits occupy a premium segment. Reports are highlighting a clear trend: community-based, technology-enabled credits that demonstrate measurable, real-world decarbonisation can attract prices two to four times higher than the market average[30,31,32,33,34]. With annual carbon savings quantified each year and permanently recorded on-chain, Neutra is equipped to meet this growing demand and unlock the full value of distributed household climate action.

3.2 Why Blockchain?

Blockchain provides the foundation for Neutra's integrity and transparency. Each carbon credit is issued, transferred, and retired on-chain, creating a permanent, auditable record of its lifecycle ensuring each credit is transparently linked to a verified installation, recorded immutably from creation to retirement and cannot be reused, oversold or duplicated[31,43,44,45]. Blockchain transforms carbon credits from static, unverifiable certificates into dynamic, programmable assets that are ready for compliance systems, ESG reports, or future integration with DeFi and DAOs. Table 1 shows real world examples of the problems faced by the carbon market and how Blockchain can solve these.

Carbon Market Problem	Blockchain-Based Solution
Opaque credit ownership and provenance	Transparent on-chain registry of issuance and retirement
Risk of double-counting or fraud	Unique, non-fungible credit IDs; credits burned on retirement
Manual, slow verification processes	Smart contracts automate rules and integrate installer data
Low buyer trust in offset impact	Verifiable, auditable metadata for every token issued

Table 1: Carbon Market Problems and Blockchain-Based Solution

3.3 Verification and Accreditation Strategy

Neutra will combine installer-submitted data with automated validation tools to calculate annual emissions savings from each ASHP installation using standardised, regulatory-aligned frameworks. The protocol will pursue accreditation under established carbon standards (such as Gold Standard[40] and Verra[5]). Credits will be issued annually based on verified performance data and permanently recorded on-chain for full transparency and auditability. This ensures Neutra meets the trust and reporting requirements of institutional buyers and emerging regulatory frameworks.

Neutra is also exploring pathways to integrate with the emerging Article 6.4 mechanism under the Paris Agreement[46], (see Figure 2), which establishes a UN-regulated global carbon market for high-integrity credits. By aligning with Article 6.4, Neutra credits can achieve the highest tier of international recognition, making them eligible for compliance markets and sovereign climate targets in addition to voluntary offsetting. This strategic alignment strengthens the credibility and liquidity of Neutra's credits, ensures adherence to the most rigorous standards for additionality and transparency, and positions the platform at the forefront of a unified global carbon economy.

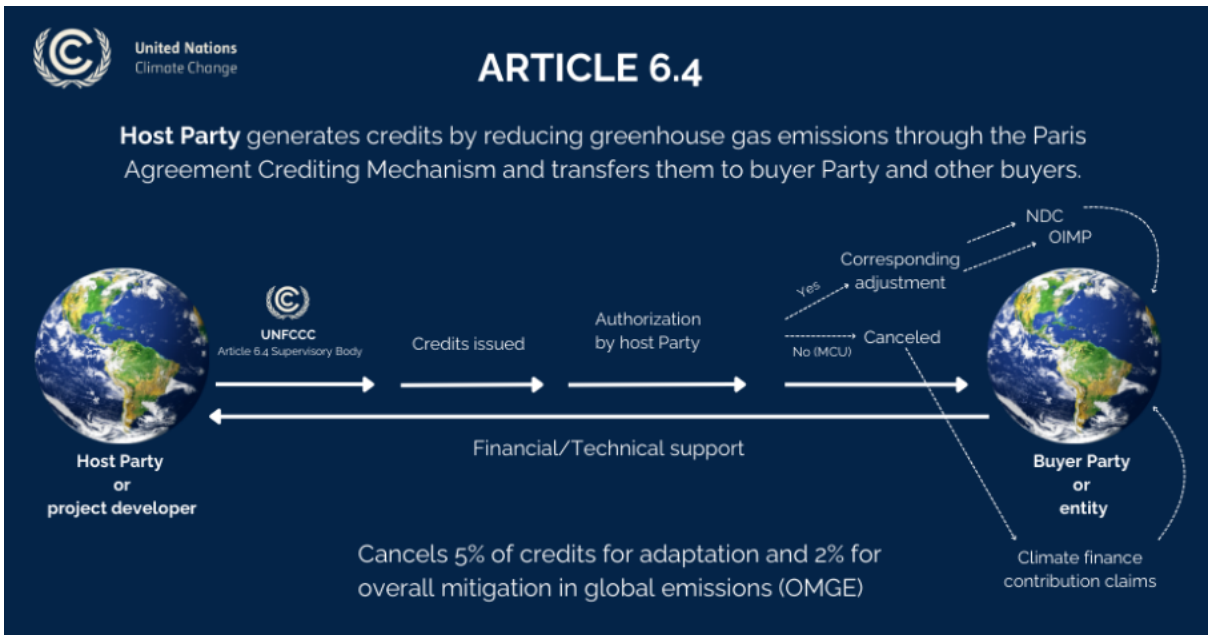

Figure 2: United Nations Climate Change Article 6.4[46]

3.4 How It Works: Step-by-Step Lifecycle

1. **Household Enrolment and Baseline Registration:** A homeowner enrols through Neutra's platform or an accredited installer partner. The household's energy profile is recorded (e.g., smart meter data, prior heating method) to establish a verifiable baseline for annual emissions comparison.
2. **Installation and Data Submission by Certified Installer:** An accredited installer completes the ASHP installation according to defined technical criteria (fuel switch, home size, efficiency thresholds). The installer submits project data for validation.
3. **Annual Monitoring and Verification:** Each year, Neutra automatically collects usage data (smart meter readings or installer-verified performance) to calculate the verified annual emissions reduction attributable to the system.
4. **Annual Credit Minting and Issuance:** After validation, Neutra mints on-chain carbon credits representing the annual emissions reduction (e.g., 2 tonnes CO_2 avoided). Each credit is uniquely identified, fully traceable, and linked to the specific installation and monitoring data.
5. **Sale and Distribution of Proceeds:** Credits are aggregated and sold to ESG-focused corporate buyers. Revenue is distributed as recurring annual cashback payments to the household, with Neutra retaining a service fee. Buyers can choose to retire credits immediately or hold them for sustainability reporting. All transactions are recorded on-chain to ensure transparency and prevent double-counting.

3.5 Pricing Strategy

Neutra's pricing model is benchmarked to real-world market data, drawing on the proven success of Snugg, which sold high-integrity domestic carbon credits at $90/tonne CO_2e (~$90). Each air-source heat pump installation is estimated to reduce emissions by 2.5 tonnes per year, creating a gross annual credit value of approximately $225 per household.
The Neutra protocol applies a transparent revenue split:

- 80% of credit revenue is returned to the household in the form of cashback, delivered automatically via smart contracts.
- 20% is retained by the Neutra platform to cover verification, contract execution, and platform maintenance.

This structure ensures that most value flows to the homeowner, driving adoption, while also creating a sustainable incentive model for long-term protocol operation. Credits will be priced dynamically in the open market but anchored by this baseline valuation model, allowing alignment with evolving carbon market standards and buyer demand.

3.6 Business Model & Revenue Streams

Neutra generates revenue by facilitating the sale of verified tokenised carbon credits derived from household decarbonisation. The platform operates on a simple but scalable model, while supporting long-term operational sustainability.

Revenue Streams

The primary source of income is a fixed share of carbon credit sales. For each verified tonne of carbon dioxide equivalent (tCO_2e) issued annually and sold to a buyer, Neutra retains a 20% service fee. The remaining 80% is distributed as recurring annual cashback payments to participating households, creating a sustained incentive to maintain and operate decarbonisation systems over time.

Each year, credits are aggregated into verified batches, sold to ESG-focused corporate buyers, and monetised via transparent on-chain settlement. This ensures all participants receive their share of proceeds in a fully auditable process.

To support DeFi-native adoption and maximise value for stakeholders, Neutra will also enable optional mechanisms for staking and liquidity:

Cashback Staking: Participants who receive annual cashback payouts will have the option to stake their rewards in protocol-managed yield vaults. By locking their funds in these smart contracts, they can earn additional yield over time, turning decarbonisation incentives into an accessible savings and compounding vehicle.

Staked cashback can be deployed into conservative DeFi strategies, such as lending stablecoins to reputable protocols (e.g., Aave or Compound), or into liquidity pools paired with tokenised carbon credits. This offers households and small businesses an alternative to immediate withdrawal, enabling them to maximise the financial benefit of their climate-positive actions. Over time, Neutra plans to integrate staking rewards tiers, giving higher yield incentives to participants who commit longer lock-up periods or contribute more credits to the system.

Liquidity Pools and Trading: Tokenised carbon credits issued by Neutra will be structured as standardised ERC-20 or NFT-based assets that can be contributed to decentralised liquidity pools on platforms such as Uniswap or Curve. This creates a liquid secondary market for verified carbon credits, facilitating price discovery, tradability, and collateralisation.

By enabling credits to be pooled and exchanged freely, Neutra transforms what has traditionally been an illiquid, over-the-counter product into a programmable climate asset class. Corporate buyers, climate funds, and retail participants can access credits transparently, trade them in real time, or use them as collateral for borrowing and staking strategies. Liquidity pools also help set credible, on-chain market references for pricing, further strengthening trust and transparency in the ecosystem.

Secondary or future revenue opportunities will be developed from this foundation. A tokenised carbon credit exchange and Verification-as-a-Service (VaaS) offering can be deployed once the platform is proven. VaaS services may be provided to third-party energy projects or utilities seeking independent validation tools.

Long-Term Financial Sustainability

Neutra is built to scale with national decarbonisation goals. As government mandates push for millions of household electrification upgrades across the UK and EU, the available credit supply and corresponding revenue expands significantly.

By anchoring revenue in verified environmental impact and aligning with public policy objectives, Neutra offers a resilient and predictable financial model that avoids the volatility of speculative markets. Its success is tied to infrastructure growth, ensuring long-term sustainability as climate investment shifts toward measurable, real-world outcomes.

4. Use Cases and Market Validation

4.1 Real-World Use Case: HACT Retrofit Credits

The Housing Associations' Charitable Trust Retrofit (HACT) Retrofit Credits initiative[47] in the United Kingdom provides a real-world example of monetising household-level carbon savings through carbon markets. Developed by HACT and PNZ Carbon, this program enables social housing providers to earn carbon credits for energy efficiency upgrades such as ASHP's and insulation improvements. The credits are issued under Verra and are sold to corporate buyers seeking high-integrity, localised offsets.

Each tonne of carbon dioxide avoided is verified and credited annually, with the revenue from these credits reinvested into further retrofits. This model demonstrates the viability of using future carbon savings as a source of funding for upfront installation costs. An early pilot[48] raised £100,000 in carbon credits with expectations of raising over £7 million over the next 20 years, validating demand among organisations that value local impact and measurable climate benefits. HACT's success validates the underlying premise of Neutra, showcasing that verified residential emissions reductions can form a valuable, high-integrity carbon asset class.

4.2 Traditional Program Examples

Globally, traditional carbon offset programs have proven that small-scale, community-level carbon reductions can be successfully quantified and monetised whilst bringing wider socioeconomic benefits of improved air quality and warmer homes. Real world examples of success include improved cookstove initiatives in Sub-Saharan Africa[49] and building retrofit projects such as the Kuyasa project in South Africa[50]. These projects have issued millions of credits and generated sustained demand, particularly among buyers seeking social co-benefits alongside carbon emissions reductions. Despite the real-world benefits of these programs, they have faced costly challenges which negatively impacted their credibility: greenwashing and double-counting due to poor monitoring resulted in loss of trust with investors and buyers. Neutra addresses these issues through its on-chain transparency model, ensuring utmost integrity and ethical values are met.

4.3 Learning from Web3 Carbon Markets

Web3 projects like Toucan Protocol[51] and KlimaDAO[52] demonstrated the potential for blockchain-based carbon markets to scale liquidity and transparency. While they succeeded in bringing legacy carbon credits on-chain, they also exposed major flaws in quality control where many credits traded were of questionable integrity, and the systems relied heavily on speculative demand. Rather than bridging legacy credits, Neutra originates new carbon credits tied to real-world installations, verified through trusted frameworks and smart data, creating a more focused, integrity-first approach. By combining the transparency and programmability of Web3 infrastructure with strict verification, Neutra creates a next-generation carbon asset that

is credible, compliant with the VCS quality assurance principles, and aligned with climate policy and plans to reach net zero.

4.4 Future Outlook: Infrastructure for the Next Generation of Carbon Markets

Neutra is positioned to become the foundational infrastructure for the tokenisation of carbon reductions across all sectors. While the protocol begins with residential ASHP, its modular architecture and transparent verification framework can be extended to other categories of distributed and policy-aligned emissions reductions, including building retrofits, small-scale renewables, and even municipal or industrial energy efficiency projects.

In a future decentralised carbon market, Neutra can act as a universal issuance and verification layer, enabling credits to serve as standardised units for ESG reporting, DAO treasury assets, and automated offsetting within Web3 and traditional ecosystems alike. By combining annual credit issuance, verifiable data streams, and on-chain auditability, Neutra has the potential to become the global gold standard framework for a high-integrity carbon credit economy.

5. Impact and ESG Benefits

Neutra delivers measurable environmental outcomes, aligns with public climate goals, and sets a new standard for transparency and trust in the VCM. By turning the annual verified emissions savings of residential ASHP installations into tradable carbon credits, it channels private capital directly into decarbonisation at the household level, creating both immediate and lasting impact.

5.1 Quantified Environmental Impact

Every ASHP installation reduces carbon emissions by replacing fossil-fuel-based heating with efficient, electric alternatives. The exact carbon savings depend on the type of heating system being replaced, the size of the property, the local electricity grid's carbon intensity, and usage patterns. On average, Neutra estimates that each household avoids around 2.5 tonnes of carbon dioxide (CO_2) emissions per year. Under Neutra's model, carbon credits are minted annually based on verified performance data, ensuring that issuance reflects actual emissions reductions achieved over time. This means each participating home can generate approximately 2.5 verified credits per year, creating a predictable, recurring stream of climate impact.
To illustrate the cumulative impact over 10 years of continuous operation:

Homes Connected	Estimated Lifetime CO_2 Savings
100	~2,500 tCO_2
1,000	~25,000 tCO_2
10,000	~250,000 tCO_2
100,000	~2.5 million tCO_2

Table 3: Cumulative impact of Neutra's emissions reductions over 10 years

These numbers show how even a relatively modest rollout can produce meaningful emissions reductions. If scaled to meet national deployment targets demonstrated in Table 4, Neutra has the potential to unlock gigaton-scale climate benefits.

Region	Target
UK	600,000 installations per year
EU	60 million installations by 2030

Table 4: Set target installations in the UK and Europe

5.2 Economic and Policy Contribution

By issuing carbon credits annually based on verified performance, Neutra creates a direct financial incentive to adopt low-carbon heating. Based on a market price of $90 per tonne, each home is expected to generate approximately $225 in credit value per year, creating a predictable and recurring income stream. Of this, 80% is returned to the homeowner as cashback, with the remaining 20% funding Neutra's infrastructure, verification, and operations.

This mechanism transforms verified annual emissions reductions into sustained financial incentives. It reduces the lifetime cost of ASHP installations for homeowners, boosts demand for certified installers and provides a new route for corporate ESG buyers to meet sustainability targets. Most importantly, it achieves this without relying on government subsidies. Instead, it mobilises private capital in support of public energy and climate goals, turning policy alignment into a source of market momentum.

5.3 Transparent and Verifiable Climate Action

A major challenge in existing carbon markets is that credits are often hard to verify, poorly documented, or double-counted. Neutra eliminates these risks by embedding verification and traceability into the design of the system. Each installation is carried out by a certified installer who submits standardised data on the property and heating system. The emissions savings are calculated using transparent, regulator-aligned frameworks. These savings are then tokenised and recorded as digital assets on a public blockchain ledger.

Once issued, every carbon credit can be traced from its origin (the installation) through its sale to its retirement, where it is permanently removed from circulation. This process ensures that each credit reflects a verified annual emissions reduction. Regulators, auditors, and buyers can verify this data at any time, ensuring integrity and compliance with emerging climate disclosure frameworks.

5.4 ESG and SDG Alignment

Neutra is designed to support the ESG principles that increasingly shape how corporations, investors, and governments evaluate climate initiatives. These ESG principles are often used to assess not only the financial performance of a project but also its ethical, environmental, and community impacts.

Environmentally, Neutra directly reduces greenhouse gas emissions by encouraging the shift from fossil fuel heating to clean electric alternatives. By replacing oil and gas boilers with ASHPs, the project lowers the household carbon footprint, contributes to cleaner air, and supports a broader shift to electrified energy systems powered by renewables.

For those who are more socioeconomically disadvantaged, it makes access to clean heating more equitable. One of the biggest barriers to ASHP adoption is the high upfront cost. By using carbon credit revenue to provide recurring annual cashback incentives, Neutra helps make low-carbon technology more affordable to individuals in lower-income or marginalised communities. It also supports job creation in the green economy, as demand for certified installers, energy assessors, and local suppliers grows.

From a governance perspective, Neutra ensures transparency and accountability through verifiable data, on-chain audit trails, and clear reporting standards. These governance features are increasingly important to regulators and investors who must demonstrate that carbon offsets are real, additional, and aligned with corporate sustainability disclosure rules, such as those under the EU's Corporate Sustainability Reporting Directive[53] (CSRD). Neutra also contributes to several of the United Nations Sustainable Development Goals[54] (SDGs), which are global targets aimed at improving health, education, economic opportunity, and environmental protection. The key targets aligned to Neutra's mission are as follows:

SDG 7 (Ensure access to affordable, reliable, sustainable and modern energy for all): Make ASHPs more affordable and expand access to clean heating technology.

SDG 9 (Industry, Innovation, and Infrastructure): Support the growth of a modern, clean energy infrastructure at the household level.

SDG 11 (Make cities and human settlements inclusive, safe, resilient and sustainable): Enable low-carbon living through energy efficiency and household decarbonisation.

SDG 13 (Climate Action): Deliver verified emissions reductions and providing a pathway for scalable, measurable progress toward net-zero targets.

Neutra offers a rare combination of environmental impact, social equity, and transparent governance, anchored through real infrastructure and enhanced through digital technology. It not only meets today's climate goals but lays the foundation for a more accountable, honest and meaningful carbon finance ecosystem.

6. Core System Components

Neutra is being developed as a modular infrastructure platform for issuing, managing and retiring tokenised carbon credits linked to household decarbonisation. While the technical stack will evolve over time, the foundational system components outlined below describe the intended structure and principles of operation. This architecture is designed to ensure alignment with both VCMs and regulatory expectations.

6.1 Verification Engine

At the heart of Neutra is a verification system that transforms residential ASHP data into measurable carbon savings. Certified installers will submit standardised data, such as home size, replaced heating system type, fuel source, and equipment specifications, through a dedicated interface. Emissions reductions will be calculated using region-specific benchmarks and methods aligned with trusted sources such as the UK's Department for Energy Security

and Net Zero[55] (formerly BEIS), the European Union's Energy Performance of Buildings Directive[56].

Neutra will design and apply a conservative emissions model to calculate annual carbon savings for each installation. Credits will be issued each year based on verified performance data, ensuring that issuance reflects actual emissions reductions over time. As the platform matures, integration with smart meters or IoT devices may allow for dynamic, real-time validation of emissions data, further strengthening the credibility of issued credits.

6.2 Blockchain and Smart Contract Infrastructure

All key lifecycle actions will be handled via smart contracts on a public, energy-efficient blockchain.

Smart contracts will enforce the following principles:

- Tokens are linked to a unique ASHP project ID to prevent double counting.
- Transfers and retirements are permanently recorded on-chain, ensuring a fully auditable lifecycle.

This digital-first architecture ensures that Neutra operates with built-in transparency, while laying the groundwork for future integrations with carbon registries and regulators.

6.3 Token Design and Credit Structure

Each carbon credit will represent one tonne of carbon dioxide equivalent (tCO_2e) and will be issued as a fungible token. To ensure traceability and transparency, each token will carry metadata that includes the project location, installation type, annual credit value, issuance date, and verification source.

Where appropriate, credits may be grouped under a non-fungible token (NFT) wrapper, allowing buyers to associate a credit bundle with a specific household project and detailed audit trail. This hybrid model supports both efficient trading and rich metadata visibility, facilitating due diligence for institutional buyers.

6.4 User Interfaces and Platform Tools

Neutra will support multiple user groups through tailored digital interfaces:

- Installer Portal: A workflow interface for certified installers to submit data, track project status, and trigger the credit verification process.
- Admin Console: A backend interface for Neutra's operational team to review submissions, run emissions calculations, and initiate token issuance.
- Corporate Buyer Dashboard: A marketplace for ESG-aligned buyers to purchase credit bundles, access metadata, and retire credits on-chain.
- Public Explorer: A transparency layer allowing stakeholders to browse issued and retired credits and trace the origin of each token.

These tools will be built to ensure usability, data integrity, and interoperability with emerging standards in sustainability reporting and environmental accounting.

6.5 Integrity, Compliance, and Security

Neutra is being designed to meet the highest standards of trust and compliance in the VCM. Every issued credit will be publicly traceable from origin to retirement, backed by an immutable blockchain audit trail. Double-counting is prevented using unique project identifiers and permanent retirement mechanisms.

To enhance credibility, Neutra plans to work toward accreditation under internationally recognised carbon standards, including Gold Standard and/or Verra. Smart contracts will undergo independent audits prior to main-net deployment.

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